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Bureau of Entomology and Plant Quarantine

A METHYL BROMIDE SOIL INJECTOR

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Among methods used in the control of the white-fringed beetle, it has been found in certain cases that it is desirable to fumigate soil in situ. Such fumigation of soil with either methyl bromide or carbon disulfide has been approved by the Bureau of Entomology and Plant Quarantine.2/

The use of carbon disulfide necessitates considerable common labor and the method employed can be used only within certain temperature limits which tend to restrict its general use. The physical nature of the highly volatile methyl bromide (B.P. 4.6° C., 40.3° F.) requires that it be handled in closed equipment and be released directly into the soil to insure its effectiveness and reduce the loss of material to a minimum. Methyl bromide soil injectors satisfying these requirements were used by Berry 3/ in rodent control. A commercial valve designed to discharge a small quantity of liquid methyl bromide at each operation of the valve was adapted by the Division of Control Investigations in an experimental soil injector. Certain improvements have been made in this injector incorporating valuable suggestions from several sources.4/

1/ Now with the Division of Control Investigations.

2/ United States Department of Agriculture. White-fringed beetle administrative instructions modified -- treatments authorized. B.E.P.Q.-503. Fourth revision, effective January 9, 1942.

3/ Berry, C. E. Methyl bromide as a rodenticide. Calif. Dept. Agr. Bul. 27: 172-180, illus. 1938.

4/ Acknowledgment is made in particular of suggestions from E. M. Livingstone and G. R. Swank, both of the Division of Control Investigations.

Figure 1 is a drawing of the completed injector. The liquid methyl bromide is conducted to the valve from a supply cylinder through a rubber air hose (A), capable of withstanding over 125 pounds' pressure per square inch, attached to the inlet (F) of the injector by ordinary air-hose couplings. Supply cylinders are available in 10-, 50-, and 150-pound sizes. For small jobs it is possible to place a 1-pound dispenser just above the double valve, connecting it to inlet (F). In the supply cylinders the methyl bromide is maintained under a pressure of 75 pounds per square inch or more by the addition of air. This extra pressure is necessary to maintain a rapid flow of the fumigant to the double valve chamber, permitting a more rapid operation of the injector. However, the injector may be operated, although at a slower speed, by the pressure of the methyl bromide itself.

The handle (B) is made of 1-inch pipe with the control levers (C and D) within easy reach of the operator's fingers. These control levers are attached around the angle iron (J) by welding them to a flat 1/8-inch iron strap bent to fit around the angle as shown in figure 2. The control levers are attached by rods to a flat bar (L) which is in turn solidly fixed to the valve stem (M). The control levers and bar are shown in a neutral position with both inlet and outlet closed. The control levers are opposed with internal springs in the plunger chambers which assist in returning both to the neutral position. This requires that the control levers work smoothly on the angle irons, and they are kept well lubricated with a heavy cup grease. If difficulty is found in having the control levers return to the neutral position, additional coil springs may be attached from the base (K) to the bar (L) where holes (N and O) are shown. The double valve consists of 2 sliding steel plungers operating in brass seats with 2 internal springs mentioned above capable of closing each plunger automatically when the control levers are released. Both plungers operate in the same chamber. When the inlet plunger is opened by pulling control lever (C) the chamber is filled with methyl bromide by the pressure in the supply cylinder. The operator can see when the chamber is filled, as the pressure gauge (I) will indicate a steady pressure equal to that in the supply cylinder. Since both plungers are operated by the same stem (M), it is not possible for both to be open at the same time. When the chamber is filled, the control lever (C) is released, closing the inlet. Control lever (D) is then pulled to open the outlet plunger and held until the expansion of the methyl bromide forces the fumigant out through the needle (H). This will be shown to be complete when the pressure gauge indicates zero pressure within the chamber. The pressure gauge should be faced

so that the operator can see it while operating the injector. A short pipe (G) connects the outlet (E) with the base (K). The frame is made of angle iron (J) welded to handle (B) and the base (K), a piece of bar steel 1 by 2 by 4 inches drilled to receive pipe (G) and needle (H). The needle or point (H) is made of one-half inch shafting with a one-eighth inch boring and 2 staggered crossholes one-sixteenth inch in diameter near the tip as shown in figure 1. These crossholes are bored at right angles to each other and must be countersunk to prevent plugging with soil.

In the operation of the injector the ground should be marked in some manner to indicate the locations where the methyl bromide should be applied. Control (C) is lifted and held as the injector is thrust into the ground so that the chamber will be filled as soon as or before the needle is completely inserted to the desired depth. When the needle is completely inserted, lever (C) is released and lever (D) lifted to release the increment of methyl bromide into the soil. Each operation of the control lever should be checked with the pressure gauge until the operator is familiar with the time required for each injection. Usually it requires from 1 to 2 seconds to fill the chamber or expel the fumigant. The increments used were 7.5 cubic centimeters. This could easily be increased by adding to the size of the chamber with a short piece of pipe between the gauge and the chamber. It has been found difficult to make use of increments of less than 5 cubic centimeters with a chamber of the present size. The injector has been operated with about 30 feet of hose from the cylinder to the injector, which gives a working area of reasonable size. The liquid methyl bromide does not attack the brass valve but will rust the iron parts and affects the rubber hose. Synthetic rubber is more resistant to the action of the methyl bromide but is not available. Standard air hose has been used over a period of a year.

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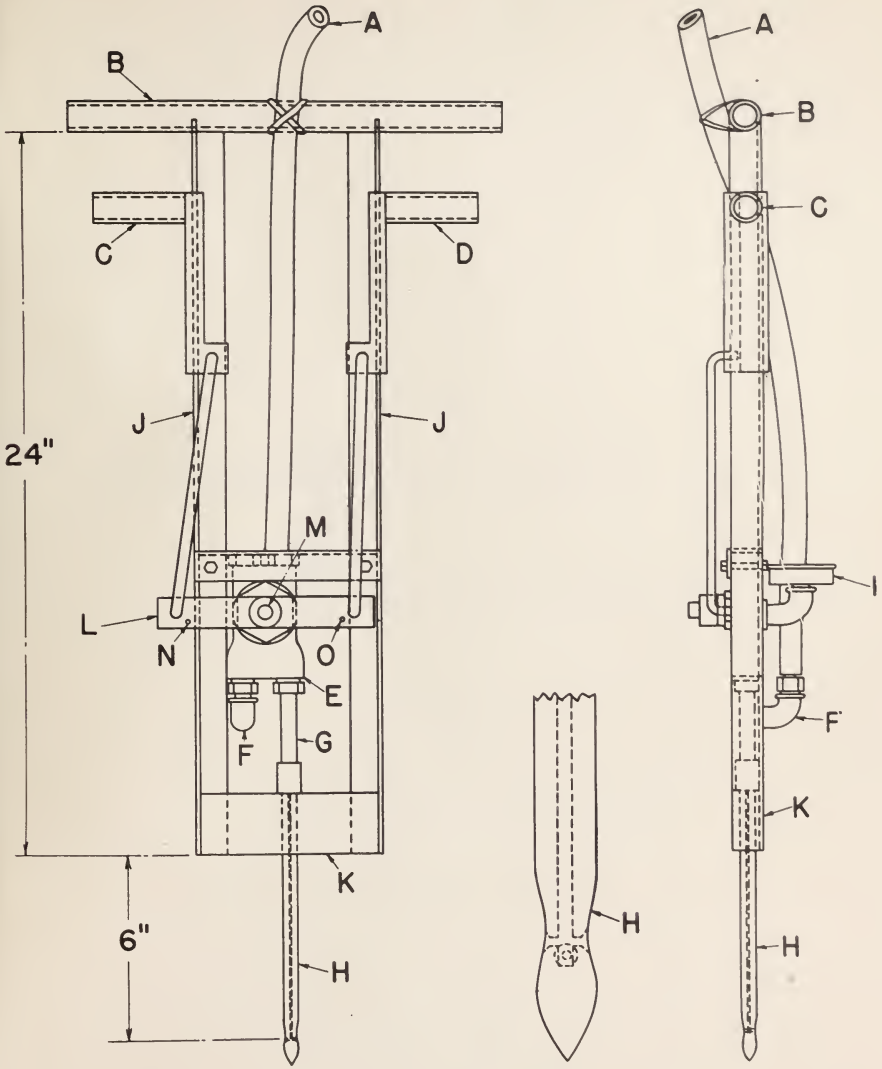

FIGURE I

The complete soil injector, front and side views.

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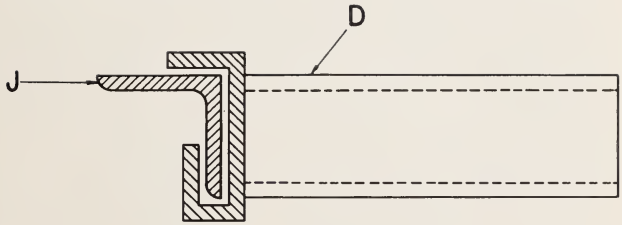

FIGURE 2

Handle and sliding part shown partly enclosing the angle iron of the frame.

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